

## WHAT IS CLAIMED IS:

1           1. A current-drive apparatus for a display panel,  
2 comprising:

3           a plurality of current-drive circuits connected in cascade  
4 and configured so that each of said plurality of current-drive  
5 circuits comprises a reference current generation section  
6 including a reference resistor and operating so that a reference  
7 current generated from outside said plurality of current-drive  
8 circuits is allowed to flow through said reference resistor and  
9 at least one internal reference current is generated in response  
10 to flow of said at least one internal reference current; and

11           a reference current source allowing said external  
12 reference current to flow through said plurality of current-drive  
13 circuits,  
14

15           said current-drive circuit being operable to sum up said  
16 at least one internal reference current in a desired number and  
17 output a desired number of internal reference currents to a  
18 display element of said display panel.

1           2. The current-drive apparatus according to claim 1,  
2 wherein said reference current generation section further  
3 comprises at least one current adjustment resistor and operates  
4 so that a reference voltage generated across said reference  
5 resistor is applied across each of said plurality of current  
6 adjustment resistors to generate said at least one internal  
7 reference current.

1           3. The current-drive apparatus according to claim 1,  
2 wherein said reference resistor of said current-drive circuit  
3 chosen out of said plurality of current-drive circuits and  
4 located on the side of a high voltage supply is connected to  
5 said high voltage supply through a voltage adjustment resistor  
6 and said reference resistor of said current-drive circuit chosen  
7 out of said plurality of current-drive circuits and located on  
8 the side of a low voltage supply is connected to said reference  
9 current source.

1           4. The current-drive apparatus according to claim 1,  
2 wherein each of said plurality of current-drive circuits  
3 comprises a voltage adjustment circuit connected to a terminal  
4 of said reference resistor on the side of a high voltage supply  
5 and wherein said plurality of current-drive circuits are  
6 configured so that when said plurality of current-drive circuits  
7 are biased, only said voltage adjustment circuit of said  
8 current-drive circuit chosen out of said plurality of  
9 current-drive circuits and located nearest to said high voltage  
10 supply has a voltage drop and the remainder of said plurality  
11 of current-drive circuits is short circuited.

1           5. The current-drive apparatus according to claim 4,  
2 wherein said voltage adjustment circuit comprises a high voltage  
3 terminal, a low voltage terminal, a step-down resistor connected  
4 between said high voltage terminal and low voltage terminal,  
5 and first and second MOS transistors having conduction types  
6 different from each other and connected in parallel with said

7 step-down resistor, wherein said plurality of current-drive  
8 circuits are configured so that when said plurality of  
9 current-drive circuits are biased, only said step-down resistor  
10 of said current adjustment circuit of said current-drive circuit  
11 chosen out of said plurality of current-drive circuits and  
12 located nearest to said high voltage supply has a voltage drop  
13 and said current adjustment circuit of the remainder of said  
14 plurality of current-drive circuits becomes short circuited by  
15 turning on of at least one of said first and second MOS transistors.

1 6. The current-drive apparatus according to claim 1,  
2 wherein said reference current generation section comprises a  
3 first operational amplifier, provided as a voltage follower,  
4 for outputting a voltage appearing at a terminal of said reference  
5 resistor on the side of a high voltage supply and a plurality  
6 of second operational amplifiers, provided as a voltage follower,  
7 for outputting a voltage appearing at a terminal of said reference  
8 resistor on the side of a low voltage supply, and wherein said  
9 reference current generation section is configured so that an  
10 output of said first operational amplifier and an output of each  
11 of said plurality of second amplifiers are applied to both ends  
12 of each of said at least one current adjustment resistor to  
13 generate corresponding one of said at least one internal  
14 reference current.

1 7. The current-drive apparatus according to claim 6,  
2 wherein said reference current generation section further  
3 comprises a reference current part disposed between each of said  
4 plurality of current adjustment resistors and said low voltage

5 supply, and is configured so that an output of corresponding  
6 one of said plurality of second operational amplifiers is input  
7 to said reference current part in order to allow said  
8 corresponding one of said at least one internal reference current  
9 to flow to said low voltage supply.

1 8. The current-drive apparatus according to claim 1,  
2 wherein each of said plurality of current-drive circuits further  
3 comprises at least one current-drive section, wherein each of  
4 said at least one current-drive section mirrors corresponding  
5 one of said at least one internal reference current to generate  
6 a plurality of mirror currents and sums up a desired number of  
7 mirror currents out of said plurality of mirror currents in order  
8 to output sum of said desired number of mirror currents.

1 9. The current-drive apparatus according to claim 8,  
2 wherein each of said at least one current-drive section further  
3 comprises a plurality of switches corresponding to said plurality  
4 of mirror currents and operates so that said plurality of switches  
5 are selectively turned on to allow said sum up of said desired  
6 number of mirror currents.

1 10. The current-drive apparatus according to claim 8,  
2 wherein each of said at least one current-drive section further  
3 comprises a plurality of switches corresponding to said plurality  
4 of mirror currents and operates so that said plurality of switches  
5 are selectively turned on to allow said sum up of said desired  
6 number of mirror currents and wherein each of said plurality  
7 of current-drive circuits operates to sum up at least one set

8 of said desired number of mirror currents and outputs sum of  
9 said at least one set of said desired number of mirror currents  
10 to said display element, thereby determining brightness of light  
11 emitted by said display element.

1 11. The current-drive apparatus according to claim 6,  
2 wherein a set of three sub-resistors is provided as each of said  
3 at least one current adjustment resistor so as to correspond  
4 to three primary colors and a switch circuit for selecting one  
5 of three primary colors is provided between said set of three  
6 sub-resistors and said first operational amplifier.

1 12. The current-drive apparatus according to claim 11,  
2 wherein said switch circuit comprises a first switch group  
3 provided between said three sub-resistors and an output of said  
4 first operational amplifier and a second switch group provided  
5 between said three sub-resistors and said non-inverting terminal  
6 of said first operational amplifier.

1 13. A current-drive circuit for a display panel, comprising  
2 a reference current generation section including a reference  
3 resistor and operating so that a reference current generated  
4 from outside said current-drive circuit is allowed to flow  
5 through said reference resistor and at least one internal  
6 reference current is generated in response to flow of said  
7 reference current,

8  
9 said current-drive circuit being operable to sum up said  
10 at least one internal reference current in a desired number and

11 output a desired number of internal reference currents.

1 14. The current-drive circuit according to claim 13,  
2 wherein said reference current generation section further  
3 comprises at least one current adjustment resistor and operates  
4 so that a reference voltage generated across said reference  
5 resistor is applied across each of said at least one current  
6 adjustment resistor to generate said at least one internal  
7 reference current.

1 15. The current-drive circuit according to claim 14,  
2 wherein said reference current generation section comprises a  
3 first operational amplifier, provided as a voltage follower,  
4 for outputting a voltage appearing at a terminal of said reference  
5 resistor on the side of a high voltage supply and a plurality  
6 of second operational amplifiers, provided as a voltage follower,  
7 for outputting a voltage appearing at a terminal of said reference  
8 resistor on the side of a low voltage supply, and wherein said  
9 reference current generation section operates so that an output  
10 of said first operational amplifier and an output of each of  
11 said plurality of second amplifiers are applied to both ends  
12 of each of said at least one current adjustment resistor to  
13 generate corresponding one of said at least one internal  
14 reference current.

1 16. The current-drive circuit according to claim 15,  
2 wherein said reference current generation section further  
3 comprises a reference current part disposed between each of said  
4 at least one current adjustment resistor and said low voltage

5 supply, and operates so that an output of corresponding one of  
6 said plurality of second operational amplifiers is input to said  
7 reference current part in order to allow corresponding one of  
8 said at least one internal reference current to flow to said  
9 low voltage supply.

1 17. The current-drive circuit according to claim 13,  
2 further comprising at least one current-drive section, wherein  
3 each of said at least one current-drive section mirrors  
4 corresponding one of said at least one internal reference current  
5 to generate a plurality of mirror currents and sums up a desired  
6 number of mirror currents out of said plurality of mirror currents  
7 in order to output sum of said desired number of mirror currents.

1 18. The current-drive circuit according to claim 17,  
2 wherein each of said at least one current-drive section further  
3 comprises a plurality of switches corresponding to said plurality  
4 of mirror currents and operates so that said plurality of switches  
5 are selectively turned on to allow said sum up of said desired  
6 number of mirror currents.

1 19. The current-drive circuit according to claim 18,  
2 wherein said reference current generation section further  
3 comprises at least one current adjustment resistor and operates  
4 so that a reference voltage generated across said reference  
5 resistor is applied across each of said at least one current  
6 adjustment resistor to generate said at least one internal  
7 reference current and wherein each of said at least one  
8 current-drive section operates so that said plurality of switches

9 are selectively turned on to allow said current-drive circuit  
10 to output sum of at least one set of said desired number of mirror  
11 currents.

1 20. The current-drive circuit according to claim 15,  
2 wherein a set of three sub-resistors is provided as each of said  
3 at least one current adjustment resistor so as to correspond  
4 to three primary colors and a switch circuit for selecting one  
5 of three primary colors is provided between said set of three  
6 sub-resistors and said first operational amplifier.

1 21. A device comprising:  
2 first and second terminals;  
3 a first resistor connected between said first and second  
4 terminals to receive a reference current; and  
5 a current generation circuit responding to said reference  
6 current and generating first current.

1 22. The device according to claim 21, wherein said current  
2 generation circuit includes a second resistor, a voltage applying  
3 circuit responding to a voltage at one end of said first resistor  
4 and applying a driving voltage to one end of said second resistor,  
5 and a first driving circuit responding to a voltage at the other  
6 end of said first resistor and driving the other end of said  
7 second resistor such that said first current flows through said  
8 second resistor.

1 23. The device according to claim 22, wherein said current  
2 generation circuit further includes a third resistor having one



3 end applied with said driving voltage and a second driving circuit  
4 responding to the voltage at the other end of said first resistor  
5 and driving said third resistor such that second current flows  
6 through said third resistor.

1 24. The device according to claim 23, further comprising  
2 an output terminal, a first switch supplying, when activated,  
3 said first current to said output terminal, and a second switch  
4 supplying, when activated, said second current to said output  
5 terminal.